

**IN THE CLAIMS:**

These claims will replace all prior versions of claims in the present application.

Claim 1 is cancelled.

[Claim 2] (Currently Amended) A method of building a tree data structure on a storage device comprising:

~~a node definition step of assigning unique node identifiers~~sequential integers to nodes including a root node to define the nodes; and

~~a parent-child relationship definition step of~~ creating an array containing integers assigned to parent nodes of non-root nodes in the order of the integers assigned to the non-root nodes on the storage device to define a parent-child relationship among the nodes, associating with node identifiers assigned to said non-root nodes corresponding to being nodes other than the root node, node identifiers assigned to parent nodes of the respective non-root nodes.

Claims 3 – 6 are cancelled.

[Claim 7] (Currently Amended) A method of building a tree data structure on a storage device, comprising:

a node definition step of assigning unique sequential ~~integers~~numbers to nodes including a root node while giving ~~higher~~ priority to child nodes of a certain node rather than same-generation nodes in the same generation as the certain node; and

a parent-child relationship definition step of storing in the storage device an array formed by arranging the numbers assigned to parent nodes of non-root nodes, in the order of

~~integers~~numbers assigned to the non-root nodes, ~~said non-root nodes corresponding to being~~  
nodes other than the root node, ~~integers assigned to parent nodes of the respective non-root~~  
~~nodes.~~ wherein the node definition step comprises:

a step of initially assigning a number to the root node;

a step of assigning a particular number to a single child node of one parent node  
when the one parent node has been already assigned a number and has only the single child  
node, said particular number immediately succeeding the number assigned to the one parent  
node; and

a step of assigning numbers to a plurality of child nodes of another parent node from  
a first child node to a last child node among the plurality of the child nodes in such a manner  
that a younger sibling node is assigned its number after all child nodes of an immediate older  
sibling node are assigned their numbers when said another parent node has been already  
assigned a number and has the plurality of the child nodes.

Claim 8 is cancelled.

[Claim 9] (Currently Amended) A method of building a tree data structure on a storage device comprising:

a node definition step of assigning unique sequential ~~integers~~numbers to nodes including a root node while giving ~~higher-priority to same-generation nodes~~ in the same generation as a certain node rather than child nodes of the certain node; and

a parent-child relationship definition step of storing in the storage device an array formed by arranging the numbers assigned to parent nodes of respective non-root nodes, in the order of ~~integers~~numbers assigned to the non-root nodes, said non-root nodes

~~corresponding to being~~ nodes other than the root node, ~~integers assigned to parent nodes~~  
~~corresponding to the respective non-root nodes.~~ wherein the node definition step comprises:  
a step of calculating a generation number from the root node for each node and a  
count of nodes belonging to each generation;  
a step of initially assigning a number to the root node; and  
a step of assigning numbers to all nodes in a generation succeeding a current  
generation until there are no nodes left unassigned in such a manner that the nodes from  
different parent nodes are assigned respective numbers in the order in which their parent  
nodes have been assigned respective numbers, on one hand, and that a plurality of nodes  
originating from an identical parent node are assigned their respective numbers from a first  
sibling node to a last sibling node by defining a sibling relationship among the plurality of the  
nodes.

Claim 10 is cancelled.

[Claim 11] (Currently Amended) The method according to claim 7, further comprising a  
step of extracting ~~from the array~~ sequential areas in which values above an integer number  
assigned to some node are stored from the array, thereby specifying all descendant nodes of  
the node concerned.

[Claim 12] (Currently Amended) The method according to claim 9, further comprising a  
step of extracting ~~from the array~~ sequential areas where the same value as an integer number  
assigned to some node is stored from the array, thereby specifying all child nodes of the node  
concerned.

[Claim 13] (Currently Amended) A method of building a tree data structure on a storage device comprising:

a step of uniquely assigning sequentially varying ~~integers~~numbers to all nodes while starting from a root node; and

a step of defining parent-child relationship among nodes, wherein the step of uniquely assigning the ~~integers~~numbers to all the nodes comprises:

a step of selecting a mode for assigning numbers to nodes between~~determining which one of a depth-first mode for assigning numbers to child nodes of a certain node in preference to earlier than nodes in the same generationsame-generation as the certain nodes~~ and a width-first mode for assigning numbers to nodes in the same generation as a certain nodesame-generation nodes in preference to earlier than child nodes of the certain nodes~~should be selected to assign numbers to nodes;~~

a step of ~~searching~~retrieving the nodes in the depth-first mode when the depth-first mode is selected, and assigning the numbers to the nodes in the ~~search~~retrieval order; and

a step of ~~searching~~retrieving the nodes in the width-first mode when the width-first mode is selected, and assigning the numbers to the nodes in the ~~search~~retrieval order,

wherein the step of defining the parent-child relationship among the nodes includes a step of storing numbers assigned to parent nodes in the storage device~~corresponding to the child nodes~~ in the order of numbers assigned to ~~the child nodes concerned~~corresponding to the respective parent nodes.

[Claim 14] (Currently Amended) The method according to claim 13, wherein the step of defining the parent-child relationship among the nodes comprises:

a step of selecting a mode for defining the parent-child relationship among the nodes~~determining which one of~~between a child-parent expression mode for defining the

relationship from a child node to a parent node and a parent-child expression mode for defining the relationship from a parent node to a child node ~~should be selected to define the parent-child relationship;~~

a step of storing ~~in the storage device~~ numbers assigned to parent nodes ~~corresponding to child nodes in the storage device~~ in the order of numbers assigned to the child nodes corresponding to the respective parent nodes ~~concerned~~ when the child-parent expression mode is selected; and

a step of storing ~~in the storage device~~ numbers assigned to child nodes ~~corresponding to parent nodes in the storage device~~ in the order of numbers assigned to the parent nodes corresponding to the respective child nodes ~~concerned~~ when the parent-child expression mode is selected.

[Claim 15] (Currently Amended) A method of converting an expression form of a tree data structure represented by using parent-child relationship on a storage device, the parent-child relationship being defined by storing, ~~in the order of numbers assigned to child nodes,~~ numbers assigned to parent nodes ~~corresponding to the child nodes in the storage device~~ in the order of numbers assigned to child nodes corresponding to the respective parent nodes, comprising:

a step of calculating a generation number ~~determining the generation of~~ for each node ~~of in the~~ tree data structure expressed in a depth-first mode for assigning numbers to nodes in the same generation as a certain node earlier than child nodes of the certain node ~~while giving higher priority to child nodes than same generation nodes,~~ and a count ~~counting the number~~ of nodes belonging to each generation;

a step of determining numbers assigned to nodes in each generation on the basis of the ~~number~~ count of the nodes belonging to each generation when the numbers are assigned in

a width-first mode for assigning numbers to child nodes of a certain node earlier than nodes in the same generation as the certain node~~while giving higher priority to same-generation nodes than child nodes~~;

a step of creating a conversion array for converting the numbers assigned to the respective nodes in the depth-first mode to numbers to be assigned to the nodes in the width-first mode on the basis of the ~~determined~~calculated generation number of the nodes for each node and the determined numbers assigned to the nodes in each generation; and

a step of converting the parent-child relationship ~~of the respective nodes~~for each node to another parent-child relationship expressed by the numbers assigned to the nodes in the width-first mode by using the conversion array.

[Claim 16] (Currently Amended) A method of converting an expression form of a tree data structure represented by using parent-child relationship on a storage device, the parent-child relationship being defined by storing, ~~in the order of numbers assigned to child nodes,~~ numbers assigned to parent nodes ~~corresponding to the child nodes~~ in the storage device in the order of numbers assigned to child nodes corresponding to the respective parent nodes, comprising:

a step of counting ~~the number~~a count of descendants nodes of each node ~~of in~~ at the tree data structure expressed in a width-first mode for assigning numbers to child nodes of a certain node earlier than nodes in the same generation as the certain node~~while giving higher priority to same-generation nodes than child nodes~~;

a step of creating a conversion array for converting the numbers assigned to the respective nodes in the width-first mode to numbers to be assigned to the nodes in a depth-first mode for assigning numbers to child nodes of a certain node earlier than nodes in the same generation as the certain node, wherein the number to be assigned to current node is



calculated by adding a count of older sibling nodes which originate from the same parent node as the current node and have been assigned their numbers earlier than the current node and a count of descendant nodes of the respective older sibling node to the number to be assigned to the parent node ~~of the current node with the number of older nodes out of brother nodes derived from the same parent node of the node concerned, numbers being assigned to the older nodes prior to the node concerned, and also with the number of descendants of the older brother nodes, thereby creating a conversion array for converting the numbers assigned in the width-first mode to numbers assigned in the depth-first mode for assigning numbers to nodes while giving higher priority to child nodes than same-generation nodes; and~~

a step -of converting the parent-child relationship ~~of~~for each node to ~~the~~another parent-child relationship expressed by the numbers assigned to the nodes in the depth-first mode by using the conversion array.

[Claim 17] (Currently Amended) A method of converting an expression form of a tree data structure represented by using parent-child relationship on a storage device, the parent-child relationship being defined by storing, ~~in the order of numbers assigned to child nodes, numbers assigned to parent nodes corresponding to the child nodes in the storage device~~ in the order of numbers assigned to child nodes corresponding to the respective parent nodes, comprising:

a step of ~~searching~~retrieving nodes in a depth-first order from ~~the~~a tree data structure expressed in a width-first mode for assigning numbers to child nodes of a certain node ~~while giving higher priority to same-generation nodes earlier than child nodes in the same generation as the certain node,~~ and creating a conversion array for converting the numbers assigned to the nodes in the width-first mode to numbers to be assigned to the nodes in ~~the~~a depth-first mode for assigning numbers to nodes in the same generation as a certain node

~~earlier than child nodes of the certain node~~ while giving higher priority to child nodes than same-generation nodes; and

a step of converting the parent-child relationship for each node of the respective nodes to another parent-child relationship expressed by the numbers assigned to the nodes in the depth-first mode by using the conversion array.

[Claim 18] (Currently Amended) A method of converting an expression form of a tree data structure represented by using parent-child relationship on a storage device, the parent-child relationship being defined by storing, ~~in the order of numbers assigned to child node,~~ numbers assigned to parent nodes ~~corresponding to the child nodes~~ as elements of a first array in the storage device in the order of numbers assigned to child node corresponding to the respective parent nodes, comprising:

a step of counting an ~~appearing frequency~~ occurrence count of the numbers assigned to each node as an element of the first array;

a step of reserving consecutive locations corresponding to the counted occurrence count in the storage device ~~securing sequential numbers whose number corresponds to the counted frequency,~~ as a second array ~~in the storage area~~ in order to store the numbers assigned to ~~the child nodes~~ corresponding to each node; -and

a step of successively reading ~~out the elements of~~ from the first array, and successively storing the numbers assigned to ~~of the child nodes for~~ corresponding to the elements ~~of~~ in the first array as ~~the elements of the second array~~ secured reserved for the nodes to which numbers having the values ~~coincident with~~ equal to the read elements ~~concerned~~ are assigned.



[Claim 19] (Currently Amended) A method of converting an expression form of a tree data structure represented by using parent-child relationship on a storage device, the parent-child relationship being defined by storing, ~~in the order of numbers assigned to parent nodes,~~ numbers assigned to child nodes ~~corresponding to the parent nodes as~~ elements of a first array in the storage device in the order of numbers assigned to parent nodes corresponding to the respective child nodes, comprising:

a step of ~~securing~~reserving a second array in the storage device in order to store numbers assigned to the parent nodes corresponding to the respective child nodes in the order of the numbers assigned to the child nodes ~~concerned~~; and

a step of successively reading ~~out the elements of~~from the first array and successively storing the numbers ~~of~~assigned to the parent nodes ~~for~~corresponding to the elements ~~of~~in the first array as elements of the second array ~~secured~~reserved for the nodes to which numbers having values ~~coincident with~~equal to the read elements are assigned.

[Claim 20] (Currently Amended) An information processing device of building a tree data structure on a storage device comprising:

node definition means for assigning unique node ~~identifiers~~sequential integers to nodes including a root node; and

parent-child relationship definition means for creating an array containing integers assigned to parent nodes of non-root nodes in the order of the integers assigned to the non-root nodes on the storage device to define a parent-child relationship among the nodes, ~~associating with node identifiers assigned to said non-root nodes corresponding to~~being nodes other than the root node, ~~node identifiers assigned to parent nodes of the respective non-root nodes.~~

Claims 21 –23 are cancelled.

[Claim 24] (Currently Amended) An information processing device of building a tree data structure on a storage device, comprising:

node definition means for assigning unique sequential ~~integers~~numbers to nodes including a root node while giving ~~higher~~ priority to child nodes of a certain node rather than nodes in the same generation as the certain nodes~~same-generation nodes~~; and

parent-child relationship definition means for storing in the storage device an array formed by arranging the numbers assigned to parent nodes of non-root nodes, in the order of ~~integers~~numbers assigned to the non-root nodes, said non-root nodes corresponding to being nodes other than the root node, ~~integers assigned to parent nodes of the respective non-root nodes~~, wherein the node definition means comprises:

means for initially assigning a number to the root node;

means for assigning a particular number to a single child node of one parent node when the one parent node has been already assigned a number and has only the single child node, said particular number immediately succeeding the number assigned to the one parent node; and

means for assigning numbers to a plurality of child nodes of another parent node from a first child node to a last child node among the plurality of the child nodes in such a manner that a younger sibling node is assigned its number after all child nodes of an immediate older sibling node are assigned their numbers when said another parent node has been already assigned a number and has the plurality of the child nodes.

Claim 25 is cancelled.

[Claim 26] (Currently Amended) An information processing device of building a tree data structure on a storage device comprising:

node definition means for assigning unique sequential ~~integers~~numbers to nodes including a root node while giving ~~higher~~ priority to ~~same-generation nodes~~ in the same generation as a certain node rather than child nodes of the certain node; and

parent-child relationship definition means for storing in the storage device an array formed by arranging the numbers assigned to parent nodes of respective non-root nodes, in the order of numbers~~integers~~ assigned to the non-root nodes, said non-root nodes corresponding to being nodes other than the root node, ~~integers assigned to parent nodes corresponding to the respective non-root nodes.~~ wherein the node definition means comprises:

means for calculating a generation number from the root node for each node and a count of nodes belonging to each generation;

means for initially assigning a number to the root node; and

means for assigning numbers to all nodes in a generation succeeding a current generation until there are no nodes left unassigned in such a manner that the nodes from different parent nodes are assigned respective numbers in the order in which their parent nodes have been assigned respective numbers, on one hand, and that a plurality of nodes originating from an identical parent node are assigned their respective numbers from a first sibling node to a last sibling node by defining a sibling relationship among the plurality of the nodes.

Claim 27 is cancelled.

[Claim 28] (Currently Amended) The information processing device according to claim 24, further comprising means for extracting from the array sequential areas in which values above an ~~integer~~number assigned to some node are stored from the array, thereby specifying all descendant nodes of the node concerned.

[Claim 29] (Currently Amended) The information processing device according to claim 26, further comprising means for extracting from the array sequential areas where the same value as an ~~integer~~a number assigned to some node is stored, thereby specifying all child nodes of the node concerned.

[Claim 30] (Currently Amended) An information processing device of building a tree data structure on a storage device comprising:

means for uniquely assigning sequentially varying ~~integers~~numbers to all nodes while starting from a root node; and

means for defining parent-child relationship among nodes, wherein the means for uniquely assigning the ~~integers~~numbers to all the nodes comprises:

means for selecting a mode for assigning numbers to nodes between~~determining which one of~~ a depth-first mode for assigning numbers to child nodes of a certain node in preference to earlier than nodes in the same generation as the certain nodes~~same-generation nodes~~ and a width-first mode for assigning numbers to nodes in the same generation as a certain node same-generation nodes in preference to earlier than child nodes of the certain nodes~~should be selected to assign numbers to nodes~~;

means for ~~searching~~retrieving the nodes in the depth-first mode when the depth-first mode is selected, and assigning the numbers to the nodes in the ~~search~~retrieval order; and

means for ~~searching~~retrieving the nodes in the width-first mode when the width-first mode is selected, and assigning the numbers to the nodes in ~~the search~~retrieval order,

wherein the means for defining the parent-child relationship among the nodes includes means for storing numbers assigned to parent nodes in the storage device~~corresponding to the child nodes~~ in the order of numbers assigned to ~~the~~ child nodes ~~concerned~~corresponding to the respective parent nodes.

[Claim 31] (Currently Amended) The information processing device according to claim 30, wherein the means for defining the parent-child relationship among the nodes comprises:

means for selecting a mode for defining the parent-child relationship among the nodes ~~determining which one of~~between a child-parent expression mode for defining the relationship from a child node to a parent node and a parent-child expression mode for defining the relationship from a parent node to a child node ~~should be selected to define the parent-child relationship~~;

means for storing ~~in the storage device~~ numbers assigned to parent nodes ~~corresponding to child nodes~~ in the storage device in the order of numbers assigned to the child nodes corresponding to the respective parent nodes~~concerned~~ when the child-parent expression mode is selected; and

means for storing ~~in the storage device~~ numbers assigned to child nodes ~~corresponding to parent nodes~~ in the storage device in the order of numbers assigned to the parent nodes corresponding to the respective child nodes~~concerned~~ when the parent-child expression mode is selected.

[Claim 32] (Currently Amended) An information processing device of converting an expression form of a tree data structure represented by using parent-child relationship on a

storage device, said storage device holding the parent-child relationship defined by assigning, ~~in the order of numbers assigned to child nodes,~~ numbers to parent nodes ~~corresponding to the child nodes~~ in the order of numbers assigned to child nodes corresponding to the respective parent nodes, comprising:

means for calculating a generation number ~~of determining the generation of~~ each node ~~of in a~~ the tree data structure expressed in a depth-first mode for assigning numbers to nodes in the same generation as a certain node earlier than child nodes of the certain node ~~while giving higher priority to child nodes than same generation nodes,~~ and counting the ~~number~~ a count of nodes belonging to each generation;

means for determining numbers assigned to nodes in each generation on the basis of the ~~number~~ count of the nodes belonging to each generation when the numbers are assigned in a width-first mode for assigning numbers to child nodes of a certain node earlier than nodes in the same generation as the certain node ~~while giving higher priority to same generation nodes than child nodes;~~

means for creating a conversion array for converting the numbers assigned to ~~of the~~ respective nodes in the depth-first mode to numbers to be assigned in the width-first mode on the basis of the ~~determined~~ calculated generation number ~~of the nodes for each node~~ and the determined numbers assigned to the nodes in each generation; and

means for converting the parent-child relationship ~~of the respective nodes for each node~~ to another parent-child relationship expressed by the numbers assigned to the nodes in the width-first mode by using the conversion array.

[Claim 33] (Currently Amended) An information processing device of converting an expression form of a tree data structure represented by using parent-child relationship on a storage device, said storage device holding the parent-child relationship defined by assigning,



~~in the order of numbers assigned to child nodes, numbers to parent nodes corresponding to the child nodes in the order of numbers assigned to child nodes corresponding to the respective parent nodes, comprising:~~

~~means for counting the number a count of descendants nodes of each node of in at the tree data structure expressed in a width-first mode for assigning numbers to child nodes of a certain node earlier than nodes in the same generation as the certain node while giving higher priority to same-generation nodes than child nodes;~~

~~means for creating a conversion array for converting the numbers assigned to the respective nodes in the width-first mode to numbers to be assigned to the nodes in a depth-first mode for assigning numbers to child nodes of a certain node earlier than nodes in the same generation as the certain node, wherein the number to be assigned to current node is calculated by adding a count of older sibling nodes which originate from the same parent node as the current node and have been assigned their numbers earlier than the current node and a count of descendant nodes of the respective older sibling node to the number to be assigned to the parent node of the current node with the number of older nodes out of brother nodes derived from the same parent node of the node concerned, numbers being assigned to the older nodes prior to the node concerned, and also with the number of descendants of the older brother nodes, thereby creating a conversion array for converting the numbers assigned in the width-first mode to numbers assigned in the depth-first mode for assigning numbers to nodes while giving higher priority to child nodes than same-generation nodes; and~~

~~means for converting the parent-child relationship of for each node to the another parent-child relationship expressed by the numbers assigned to the nodes in the depth-first mode by using the conversion array.~~

[Claim 34] (Currently Amended) An information processing device of converting an expression form of a tree data structure represented by using parent-child relationship on a storage device, said storage device holding the parent-child relationship defined by assigning, ~~in the order of numbers assigned to child nodes,~~ numbers to parent nodes ~~corresponding to the child nodes~~ in the order of numbers assigned to child nodes corresponding to the respective parent nodes, comprising:

means for ~~searching~~ retrieving nodes in a depth-first order from the tree data structure expressed in a width-first mode for assigning numbers to child nodes of a certain node earlier than nodes in the same generation as the certain node ~~while giving higher priority to same-generation nodes than child nodes~~, and creating a conversion array for converting the numbers assigned to the nodes in the width-first mode to numbers to be assigned to the nodes in the ~~the~~ depth-first mode for assigning numbers to nodes in the same generation as a certain node earlier than child nodes of the certain node ~~while giving higher priority to child nodes than same-generation nodes~~; and

means for converting the parent-child relationship for each node ~~of the respective nodes~~ to another parent-child relationship expressed by the numbers assigned to the nodes in the depth-first mode by using the conversion array.

[Claim 35] (Currently Amended) An information processing device of converting an expression form of a tree data structure represented by using parent-child relationship on a storage device, wherein the storage device holds, ~~in the order of numbers assigned to child node,~~ numbers assigned to parent nodes ~~corresponding to the child nodes~~ as elements of a first array defining the parent-child relationship in the order of numbers assigned to child node corresponding to the respective parent nodes, and said device comprises:

means for counting an ~~appearing frequency~~occurrence count of the numbers assigned to each node as an element of the first array;

means for reserving consecutive locations corresponding to the counted occurrence count in the storage device ~~securing sequential numbers whose number corresponds to the counted frequency~~, as a second array ~~in the storage area~~ in order to store the numbers assigned to ~~the~~ child nodes corresponding to each node; -and

means for successively reading ~~out the elements of~~from the first array, and successively storing the numbers assigned to ~~of~~ the child nodes ~~for~~corresponding to the elements ~~of~~in the first array as ~~the~~ elements of the second array ~~secured~~reserved for the nodes to which numbers having the values ~~coincident with~~equal to the read elements ~~concerned~~ are assigned.

[Claim 36] (Currently Amended) An information processing device of converting an expression form of a tree data structure represented by using parent-child relationship on a storage device, wherein the storage device holds, ~~in the order of numbers assigned to parent node~~, numbers assigned to child nodes ~~corresponding to the parent nodes~~ as elements of a first array defining the parent-child relationship in the order of numbers assigned to parent node corresponding to the respective child nodes, and said device comprises:

means for ~~securing~~reserving a second array in the storage device in order to store numbers assigned to the parent nodes corresponding to the respective child nodes in the order of the numbers assigned to the child nodes ~~concerned~~; and

means for successively reading ~~out the elements of~~from the first array and successively storing the numbers assigned to ~~of~~ the parent nodes ~~for~~corresponding to the elements ~~of~~in the first array as elements of the second array ~~secured~~reserved for the nodes to which numbers having values ~~coincident with~~equal to the read elements are assigned.

[Claim 37] (Currently Amended) A program for making a computer of building a tree data structure on a storage device execute:

a node definition function of assigning unique ~~node identifiers~~sequential integers to nodes including a root node; and

a parent-child relationship definition function of creating an array containing integers assigned to parent nodes of non-root nodes in the order of the integers assigned to the non-root nodes on the storage device to define a parent-child relationship among the nodes, said non-root nodes being nodes other than the root node~~associating with the node identifiers assigned to non-root nodes corresponding to nodes other than the root node, node identifiers assigned to parent nodes of the respective non-root nodes.~~

Claims 38-40 are cancelled.

[Claim 41] (Currently Amended) A program for making a computer of building a tree data structure on a storage device execute:

a node definition function of assigning unique sequential ~~integers~~numbers to nodes including a root node while giving ~~higher~~ priority to child nodes of a certain node rather than nodes in the same generation as the certain nodes~~same-generation nodes~~; and

a parent-child relationship definition function of storing in the storage device an array formed by arranging the numbers assigned to parent nodes of non-root nodes, in the order of ~~integers~~numbers assigned to the non-root nodes~~s~~, said non-root nodes ~~corresponding to~~being nodes other than the root node, ~~integers assigned to parent nodes of the respective non-root nodes.~~ wherein the node definition function comprises:

a function of initially assigning a number to the root node;

a function of assigning a particular number to a single child node of one parent node when the one parent has been already assigned a number and has only the single child node, said particular number immediately succeeding the number assigned to the one parent node; and

a function of assigning numbers to a plurality of child nodes of another parent node from a first child node to a last child node among the plurality of the child nodes in such a manner that a younger sibling node is assigned its number after all child nodes of an immediate older sibling node are assigned their numbers when said another parent node has been already assigned a number and has the plurality of the child nodes.

Claim 42 is cancelled.

[Claim 43] (Currently Amended) A program making a computer of building a tree data structure on a storage device execute:

a node definition function of assigning unique sequential ~~integers~~numbers to nodes including a root node while giving ~~higher~~ priority to nodes in the same generation as a certain node rather than child nodes of the certain nodes~~same-generation nodes than child nodes~~; and

a parent-child relationship definition function of storing in the storage device an array formed by arranging, ~~in the order of assigned non-root nodes corresponding to nodes other than the root node,~~ the ~~integers~~numbers assigned to parent nodes ~~of corresponding to the respective non-root nodes~~ in the order of numbers assigned to the non-root nodes, said non-root nodes being nodes other than the root node, ~~wherein the node definition function comprises:~~

a function of calculating a generation number from the root node for each node and a count of nodes belonging to each generation;

\_\_\_\_\_ a function of initially assigning a number to the root node; and  
\_\_\_\_\_ a function of assigning numbers to all nodes in a generation succeeding a current  
generation until there are no nodes left unassigned in such a manner that the nodes from  
different parent nodes are assigned respective numbers in the order in which their parent  
nodes have been assigned respective numbers, on one hand, and that a plurality of nodes  
originating from an identical parent node are assigned their respective numbers from a first  
sibling node to a last sibling node by defining a sibling relationship among the plurality of the  
nodes.

Claim 44 is cancelled.

[Claim 45] (Currently Amended) The program according to claim 41, further comprising  
a function of extracting ~~from the array~~ sequential areas in which values above an  
~~integer~~number assigned to some node are stored from the array, thereby specifying all  
descendant nodes of the node concerned.

[Claim 46] (Currently Amended) The program according to claim 43, further comprising  
a function of extracting ~~from the array~~ sequential areas where the same value as an  
~~integer~~number assigned to some node is stored from the array, thereby specifying all child  
nodes of the node concerned.

[Claim 47] (Currently Amended) A program for making a computer of building a tree  
data structure on a storage device execute:

a function of uniquely assigning sequentially varying integers to all nodes while  
starting from a root node; and



a function of defining parent-child relationship among nodes, wherein the function of uniquely assigning the integers to all the nodes comprises:

a function of selecting a mode for assigning numbers to nodes between~~determining which one of a depth-first mode for assigning numbers to child nodes of a certain node in preference to earlier than nodes in the same generation as the certain node same-generation nodes~~ and a width-first mode for assigning numbers to nodes in the same generation as a certain node earlier than child nodes of the certain nodes~~same-generation nodes in preference to child nodes should be selected to assign numbers to nodes;~~

a function of ~~searching~~retrieving the nodes in the depth-first mode when the depth-first mode is selected, and assigning the numbers to the nodes in the ~~search~~retrieval order; and

a function of ~~searching~~retrieving the nodes in the width-first mode when the width-first mode is selected, and assigning the numbers to the nodes in the ~~search~~retrieval order,

wherein the function of defining the parent-child relationship among the nodes includes a function of storing numbers assigned to parent nodes in the storage device~~corresponding to the child nodes~~ in the order of numbers assigned to ~~the child nodes~~ corresponding to the respective parent nodes~~concerned.~~

[Claim 48] (Currently Amended) The program according to claim 47, wherein the function of defining the parent-child relationship among the nodes comprises:

a function of selecting a mode for defining the parent-child relationship among the nodes between~~determining which one of a child-parent expression mode for defining the relationship from a child node to a parent node and a parent-child expression mode for defining the relationship from a parent node to a child node should be selected to define the parent-child relationship;~~

a function of storing ~~in the storage device~~ numbers assigned to parent nodes ~~corresponding to child nodes~~ in the storage device in the order of numbers assigned to the child nodes corresponding to the respective parent nodes ~~concerned~~ when the child-parent expression mode is selected; and

a function of storing ~~in the storage device~~ numbers assigned to child nodes ~~corresponding to parent nodes~~ in the storage device in the order of numbers assigned to the parent nodes corresponding to the respective child nodes ~~concerned~~ when the parent-child expression mode is selected.

[Claim 49] (Currently Amended) A program for making a computer of converting an expression form of a tree data structure represented by using parent-child relationship on a storage device execute:

a function of defining the parent-child relationship by storing, ~~in the order of numbers assigned to child nodes,~~ numbers assigned to parent nodes ~~corresponding to the child nodes~~ in the storage device in the order of numbers assigned to child nodes corresponding to the respective parent nodes,;

a function of calculating a generation number ~~determining the generation of~~ for each node ~~of~~ in ~~the~~ tree data structure expressed in a depth-first mode for assigning numbers to nodes in the same generation as a certain node earlier than child nodes of the certain node ~~while giving higher priority to child nodes than same-generation nodes,~~ and a count ~~counting the number~~ of nodes belonging to each generation;

a function of determining numbers assigned to nodes in each generation on the basis of the ~~number~~ count of the nodes belonging to each generation when the numbers are assigned in a width-first mode for assigning numbers to child nodes of a certain node earlier than

nodes in the same generation as the certain node~~while giving higher priority to same-generation nodes than child nodes;~~

a function of creating a conversion array for converting the numbers assigned to of the respective nodes in the depth-first mode to numbers to be assigned to the nodes in the width-first mode on the basis of the ~~determined~~calculated generation number of the nodes for each node and the determined numbers assigned to the nodes in each generation; and

a function of converting the parent-child relationship ~~of the respective nodes~~for each node to another parent-child relationship expressed by the numbers assigned to the nodes in the width-first mode by using the conversion array.

[Claim 50] (Currently Amended) A program for making a computer of converting an expression form of a tree data structure represented by using parent-child relationship on a storage device execute:

a function of defining the parent-child relationship by storing, ~~in the order of numbers assigned to child nodes,~~ numbers assigned to parent nodes ~~corresponding to child nodes~~ in the storage device in the order of numbers assigned to child nodes corresponding to the respective parent nodes;

a function of counting ~~the number~~a count of descendants nodes of each node ~~of~~in ~~at~~the tree data structure expressed in a width-first mode for assigning numbers to child nodes of a certain node earlier than nodes in the same generation as the certain node~~while giving higher priority to same-generation nodes than child nodes;~~

a function of creating a conversion array for converting the numbers assigned to the respective nodes in the width-first mode to numbers to be assigned to the nodes in a depth-first mode for assigning numbers to child nodes of a certain node earlier than nodes in the same generation as the certain node, wherein the number to be assigned to current node is

calculated by adding a count of older sibling nodes which originate from the same parent node as the current node and have been assigned their numbers earlier than the current node and a count of descendant nodes of the respective older sibling node to the number to be assigned to the parent node of the current node~~adding the number to be assigned to the parent node with the number of older nodes out of brother nodes derived from the same parent node of the node concerned, numbers being assigned to the older nodes prior to the node concerned, and also with the number of descendants of the older brother nodes, thereby creating a conversion array for converting the numbers assigned in the width first mode to numbers assigned in the depth first mode for assigning numbers to nodes while giving higher priority to child nodes than same generation nodes; and~~

a function of converting the parent-child relationship ~~offor~~ for each node to ~~the~~ another parent-child relationship expressed by the numbers assigned to the nodes in the depth-first mode by using the conversion array.

[Claim 51] (Currently Amended) A program for making a computer of converting an expression form of a tree data structure represented by using parent-child relationship on a storage device execute:

a function of defining the parent-child relationship by storing, ~~in the order of numbers assigned to child nodes, numbers assigned to parent nodes corresponding to the child nodes in the storage device~~ in the order of numbers assigned to child nodes corresponding to the respective parent nodes;

a function of retrieving nodes~~searching~~ in a depth-first order from the~~a~~ tree data structure expressed in a width-first mode for assigning numbers to child nodes of a certain node earlier than nodes in the same generation as the certain node~~while giving higher priority to same generation nodes than child nodes~~, and creating a conversion array for converting the

numbers assigned to the nodes in the width-first mode to numbers to be assigned to the nodes in ~~the~~ depth-first mode for assigning numbers to nodes in the same generation as a certain node earlier than child nodes of the certain node~~while giving higher priority to child nodes than same-generation nodes~~; and

a function of converting the parent-child relationship for each node~~of the respective nodes~~ to another parent-child relationship expressed by the numbers assigned to the nodes in the depth-first mode by using the conversion array.

[Claim 52] (Currently Amended) A program for making a computer of converting an expression form of a tree data structure represented by using parent-child relationship on a storage device execute:

a function of defining the parent-child relationship by storing, ~~in the order of numbers assigned to child node, numbers assigned to parent nodes corresponding to the child nodes~~ as elements of a first array in the storage device in the order of numbers assigned to child node corresponding to the respective parent nodes;

a function of counting an ~~appearing frequency~~ occurrence count of the numbers assigned to each node as an element of the first array;

a function of reserving consecutive locations corresponding to the counted occurrence count in the storage device ~~securing sequential numbers whose number corresponds to the counted frequency~~, as a second array ~~in the storage area~~ in order to store ~~the numbers assigned to the child nodes corresponding to each node~~; -and

a function of successively reading ~~out the elements of~~ from the first array, and successively storing the numbers assigned to ~~of~~ the child nodes ~~for~~ corresponding to the elements of ~~in~~ the first array as ~~the elements of the second array secured~~ reserved for the nodes

to which numbers having the values ~~coincident with~~equal to the read elements ~~concerned~~ are assigned.

[Claim 53] (Currently Amended) A computer for making a computer of converting an expression form of a tree data structure represented by using parent-child relationship on a storage device execute:

a function of defining the parent-child relationship by storing, ~~in the order of numbers assigned to parent nodes,~~ numbers assigned to child nodes ~~corresponding to the parent nodes~~ as elements of a first array in the storage device in the order of numbers assigned to parent nodes corresponding to the respective child nodes;

a function of ~~securing~~reserving a second array in the storage device in order to store numbers assigned to the parent nodes corresponding to the respective child nodes in the order of the numbers assigned to the child nodes ~~concerned~~; and

a function of successively reading ~~out the elements of~~from the first array and successively storing the numbers ~~of~~assigned to the parent nodes ~~for~~corresponding to the elements ~~of~~in the first array as elements of the second array ~~secured~~reserved for the nodes to which numbers having values ~~coincident with~~equal to the elements are assigned.

[Claim 54] (Previously Presented) A computer-readable recording medium recorded with the program according to claim 37.

Claims 55-60 are cancelled.